From Forest Nursery Notes, Winter 2012

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Annals of Forest Science (2011) 68:1291–1302
DOI 10.1007/s13595-011-0136-5

ORIGINAL PAPER

Growth of planted black spruce seedlings following mechanical site preparation in boreal forested peatlands with variable organic layer thickness: 5-year results

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Received: 20 April 2011 / Accepted: 7 September 2011 / Published online: 5 October 2011

Abstract
• ***Context*** Following forest harvest, mechanical site preparation (MSP) is commonly used to regenerate harvested sites. In boreal forested peatlands, however, the effectiveness of MSP to regenerate harvested sites is likely to be hampered by thick organic layers.
• ***Aim*** We sought to determine the capability of different MSP techniques to improve growth conditions of planted black spruce seedlings in boreal forested peatlands where closed-crown productive forests could revert to unproductive forested peatlands in the absence of severe soil disturbance.
• ***Methods*** The effects of disc scarification, mounding and patch scarification on soil chemistry and seedling growth were contrasted.
• ***Results*** Seedlings of site-prepared plots were 15% taller than those of untreated ones, irrespective of the MSP technique used, likely owing to the greater abundance of exposed mineral soil and mesic substrates created. Mounding and patch scarification were able to expose mineral soil over a greater proportion (>25% vs. <10%) of the treated area compared with disc scarification and control, whereas the combined surface area of exposed mineral soil and mesic substrates was higher in every MSP treatments relative to the control (>57% vs. 41%, respectively). Individual seedling growth was influenced by substrate type and drainage. Seedlings planted in moderately and well-drained mesic substrates and mineral soil were 25% taller than those planted in poorly drained fibric substrates.
• ***Conclusion*** All three MSP techniques were effective because they succeeded in creating high-quality microsites despite thick organic layers.

Keywords Black spruce · Forest floor disturbance · Mechanical site preparation · Organic layer · Seedling growth

Handling Editor: Douglas Jacobs

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1 Introduction

The variation in forest floor thickness commonly observed in forest ecosystems (Qian and Klinka 1995; Šamonil et al. 2008; Schöning et al. 2006) influences the vertical distribution of soil physico-chemical properties (Bringmark 1989; Jobbágy and Jackson 2001; Legout et al. 2008) and tree growth (Geyer et al. 1980; Meredieu et al. 1996). In boreal forests, forest floor thickness has been related to post-disturbance regeneration success (Greene et al. 2005; Jayen et al. 2006; Meunier et al. 2007), stand spatial structure (Lavoie et al. 2007a) and stand growth (Johnstone and Chapin 2006), as well as to soil nutrient and understory vegetation spatial variability (Lecomte et al. 2005; Laiho et al. 2008). Likewise, the regeneration of boreal tree species has been related to habitat factors such as water availability and paludification process (Simard et al. 2007; Yarie 2008).

Following forest harvest, mechanical site preparation (MSP) is commonly used to improve survival and growth of planted tree seedlings, and to ensure successful regen-